CAPTAIN Report – FY17 Q4

Successful Second Neutron Run!

With the improvements to the detector completed, Mini-CAPTAIN was installed in the WNR 15R beamline in April 2017 and filled with liquid argon in June 2017. The argon was purified over several weeks and the levels of oxygen and water were reduced to the target values. From July 23 to August 5, 2017, the Mini-CAPTAIN detector took neutron data at a variety of rates including as low as 1 Hz. Figure 1 shows a sample event in the X plane with the sample number (time) versus the wire number on the plane. Two tracks can be seen: a proton track and a cosmic ray track. Figure 2 shows the digitized signals from the 24 photomultiplier tubes of the photon detection system in blue, the RF trigger from the beam in green, and the sum of triggers in red. The traces clearly show the arrival of the prompt scintillation light from the neutron interaction in the liquid argon and the subsequent later light that is characteristic of liquid argon scintillation. Over 25,000 neutron interactions were recorded with the low intensity neutron beam. These data are currently being analyzed and will provide a library of neutron interactions to compare to simulations. In addition, these data will be used to determine the cross section as a function of neutron energy and the differential partial cross sections on argon for pi-0, proton, and pi+/- production. The CAPTAIN collaboration includes many postdocs and students from universities who were able to participate in the set-up and operation of the Mini-CAPTAIN detector at LANSCE and will use these data for dissertations and future publications. Figure 3 shows most of the personnel who contributed to the successful run standing in the WNR 15R beamline in front of the Mini-CAPTAIN detector in July 2017.

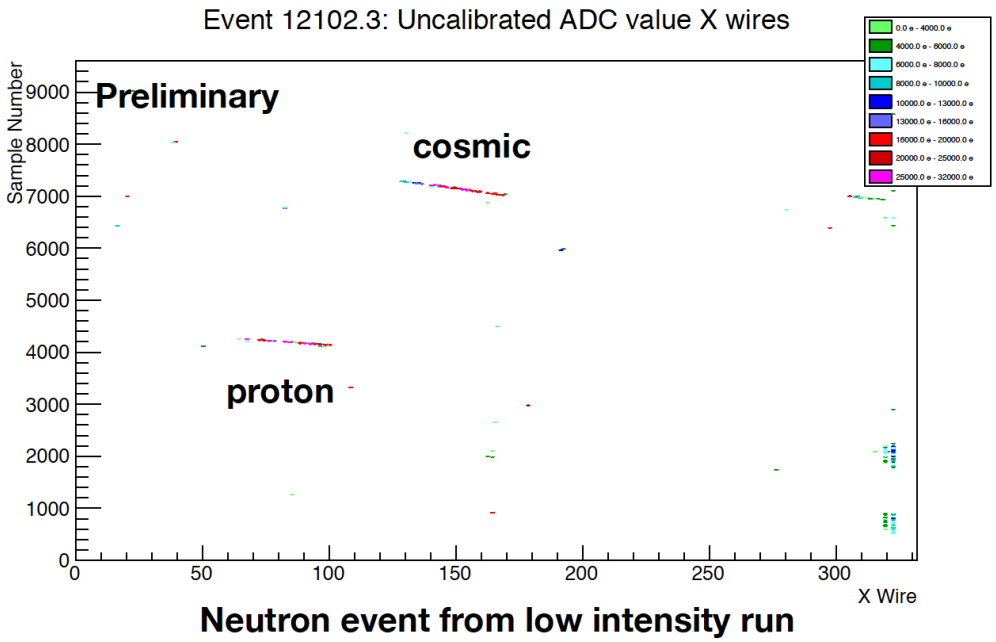

Figure 1: Sample neutron interaction event from the 2017 neutron run data. Time is shown as sample number versus the wire number in the X plane. Proton and cosmic ray tracks can be seen.

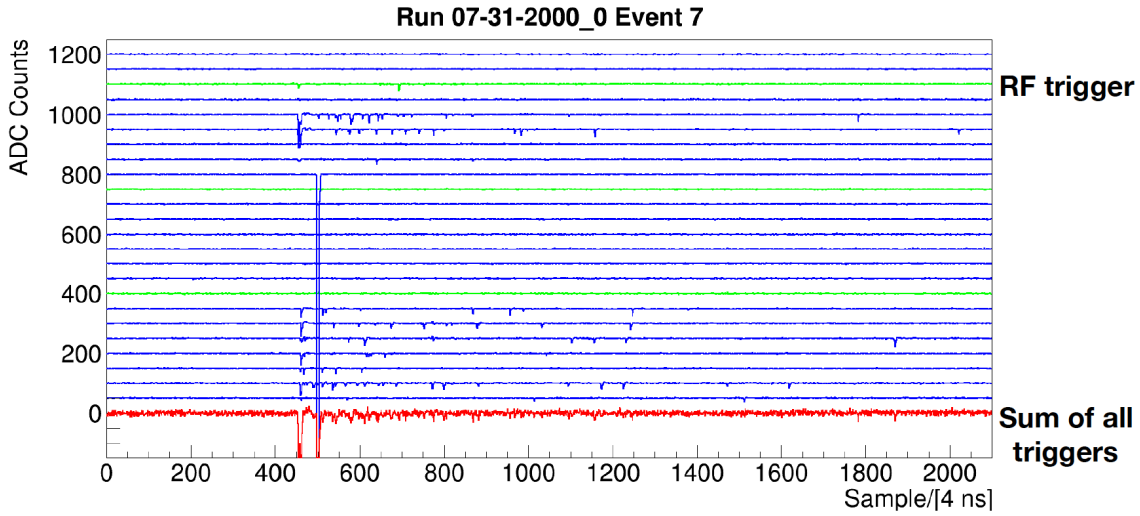

Figure 2: The digitized signals from the 24 photomultiplier tubes of the photon detection system in blue, the RF trigger from the beam in green, and the sum of triggers in red from a sample neutron event in the 2017 neutron run data.

Figure 3: Many of the students, postdocs, faculty and LANL staff that helped with the 2017 neutron run. Behind the personnel is the Mini-CAPTAIN detector sitting in the WNR 15R beamline.